

Hi-C Observations of Penumbral Bright Dots: Comparison with the IRIS Results

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Abstract

We observed bright dots (BDs) in a sunspot penumbra by using data acquired by the High Resolution Coronal Imager (Hi-C). The sizes of these BDs are on the order of 1 arcsecond ($1''$) and are therefore hard to identify using the Atmospheric Imaging Assembly's (AIA) $0.6''$ pixel $^{-1}$ resolution. These BDs become readily apparent with Hi-C's $0.1''$ pixel $^{-1}$ resolution. Tian et al. (2014) found penumbral BDs in the transition region (TR) by using the Interface Region Imaging Spectrograph (IRIS). However, only a few of their dots could be associated with any enhanced brightness in AIA channels. In this work, we examine the characteristics of the penumbral BDs observed by Hi-C in a sunspot penumbra, including their sizes, lifetimes, speeds, and intensity. We also attempt to relate these BDs to the IRIS BDs. There are fewer Hi-C BDs in the penumbra than seen by IRIS, though different sunspots were studied and Hi-C had a short observation time. We use 193 Å Hi-C data from July 11, 2012 which observed from $\sim 18:52:00$ UT– $18:56:00$ UT and supplement it with data from AIA's 193 Å passband to see the complete lifetime of the dots that were born before and/or lasted longer than Hi-C's 5-minute observation period. We use additional AIA passbands and compare the light curves of the BDs at different temperatures to test whether the Hi-C BDs are TR BDs. We find that most Hi-C BDs show

clear movement, and of those that do, they move in a radial direction, toward or away from the sunspot umbra, sometimes doing both. BDs interact with other BDs, combining to fade away or brighten. The BDs that do not interact with other BDs tend to move less and last longer. We examine the properties of the Hi-C BDs and compare them with the IRIS BDs. Our BDs are similar to the exceptional values of the IRIS BDs: they move slower on average and their sizes and lifetimes are on the higher end of the distributions of IRIS BDs. We infer that our penumbral BDs are some of the larger BDs observed by IRIS.

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